Metropolitan Sewers.

REPORT OF MR. J. L. HALE

ON

1.—The Cleansing of the King's Scholars Pond Sewer.
2.—The Reduction of the Expenses of Flushing Apparatus.
3.—And the Prevention of Effluvia in Sewers.

State of the sewer.

A few months ago the King's Scholars Pond Sewer, for the first mile and a half, next the river, was generally filled with very noxious vapour, and often the exhalations were so nauseous as to produce a feeling of sickness while walking on the banks of the open part. It contained a continuous bed of deposit, consisting of sand and all sorts of filth, varying in depth from 10 to 30 inches, and containing in the first mile more than *six thousand loads of matter*. The general velocity of the stream was slow compared with what it would have been had the sewer been clean, as its invert was well made and had a good fall. We selected this sewer to make experiments on the best mode of cleansing it.

Description of machinery used in cleansing.

We first used a machine in the form of a plough and harrow combined; a horse dragged it through the deposit in the sewer; one man attended the horse, and another guided the plough. The work done by this machine in cutting a channel through the soil and causing the water to move through it quickly, was effectual to remove the deposit; but as the King's Scholars Pond Sewer is a tidal sewer, and its only entrance for a horse being its outlet, the machine could only be used for a small part of any day. Sometimes, with a strong breeze up the river, the tide would not recede sufficiently to permit the horse to get in at all (and it did not appear advisable to incur the expense of £50 to build a side-way entrance expressly for the horse), so that under these circumstances we were obliged to discontinue the use of the horse and plough; which, under other circumstances, would have been very effective.

Cost of partial cleansing by hand.

We found that removing the soil from the centre of the sewer, and casting it on the sides only, by manual labour, cost 1*s*. 2*d*. per yard.

Experiments with other machinery.

We afterwards attached the plough and harrow to a barge, and worked them by the following arrangement. At high-water, the sluice gates were strutted and kept shut until the receding tide had made the difference of level between the water of the sewer, and the surface of the river equal to about 8 feet; the gates were then suddenly opened, and the rapid and deep current of water following was then sufficient to bring the barge and plough down the sewer with a force equal to 5 or 6 horse power. The work done each time of using the plough was very considerable, and vast quantities of soil, by these means, were removed into the river.

These latter arrangements, in connection with the plough, insured three kinds of effective work:—

1st.—The work done by the draw flush after the sluice gates were suddenly opened.

2nd.—The work done by the barge, alone, in drawing the deposit down, and drawing it a-head.

3rd.—The work done by the plough. This mode of cleansing appeared very satisfactory, as the machinery was observed moving rapidly along, ploughing up the soil and moving great quantities of matter forward to the outlet; but incidental to its preliminary arrangements there was so much loss of time, as rendered its supposed superiority to other modes of cleansing, under the particular circumstances in which it was tried, doubtful.

Experiments on cleansing with other machinery.

The next plan we tried was as follows:—The sewer, in one part, is 20 feet wide. I had five flushing boards made, 4 feet wide and 3 feet 6 inches high, each; these were placed in the deposit, across the sewer, so as to form a complete dam, and each board was held firm in its place and managed by one man. The water soon rose on the up side of this dam and overcame its resistance; the men then moved abreast backwards with their boards towards the outlet, forced and assisted by the pressure of the water, and thus the work of cleansing was very economically performed, as there was no loss of time in preparation for work; but the whole of the men's time was occupied in moving the soil; so that upon the whole, the last mode of cleansing, under the peculiar circumstances affecting the King's Scholars Pond Sewer, is superior to any other which has preceded it.

Proposed experiments with other machinery.

It was felt, notwithstanding the efficient means now at hand, that the expense of cleansing the sewer might be still further reduced, and the work of cleansing would be sooner completed, by the use of a large flushing gate, fixed at the Skew Bridge, over the Vauxhall Road, where the sewer is 14 feet wide. Estimates were accordingly prepared for such a gate. Messrs. Burton's estimate for an iron gate, six feet high, was £140, exclusive of the cost of brickwork, which would have made the total cost equal to £200. I designed a wooden gate eight feet high, to be made of 3-inch yellow deals screwed on to a frame of 6-inch oak, and to work by gudgeons in collars, the bearings of which should be solid pieces of oak built into the side walls of the sewer, and the arrangements for working were such that the gate should be shut and let off from a man-hole in the crown of the sewer, to save the expense of side entrances, the estimate for this gate, furnished by Messrs. Humphreys and Thirst, was only £12. It has, therefore, been made, and is now fixed and ready for use; and it is very confidently expected, that after a few times of using, the gate will be found to have paid all its expenses by the amount of work it will have done. This gate will be of particular use for supplying a force of water to move the dam made by the flushing boards.

Cost of iron flushing gate.

Cost of wooden flushing gate.

Quantity of deposit already removed, and the beneficial result.

Thousands of loads of matter have already been removed from the sewer; and one result is that the smells, arising from the sewer, have evidently diminished to a very great extent. This beneficial change has been observed, especially by Charles Cousins, the keeper of the sluice gates, who lives and sleeps over the mouth of the sewer.

The cleansing of the King's Scholars Pond Sewer is rendered more important at the present time, as great quantities of matter are continually being added to it by the flushing work undertaken by contract; and the flushing operations in the collateral sewers as well as the ordinary currents of water are impeded in proportion to the amount of deposit raising the bed of the main sewer.

The neeessity of cleansing the K. S. P. Sewer in particular, and main sewers generally.

Flushing gates are chiefly of use in sewers badly constructed and without falls, but containing plenty of water; and they are of very little use where the gate has to be shut twenty-fours and longer before a head of water has accumulated; but where intermittent flushing is practised, strong smells are often caused *solely by* the stagnation of the water or sewage, while accumulating behind the gate. I have observed this, as a very clear fact, in several instances.

Where flushing gates are chiefly required.

The evils of intermittent flushing.

We have been very successful in reducing the expenses of flushing gates, as appears by the following estimates on which gates have been made and fixed.

Reduetions in the cost of flushing gates have been effeeted.

A 3 feet 6 inches by 2 feet 6 inches best elm gate, including the iron work, and all other necessary appurtenances, 14*s*.

The cost of wooden gates.

Messrs. Burton's price for an iron gate, the same size 3 feet 6 inches by 2 feet 6 inches, including the same particulars, £7 6*s*.

The cost of iron gates.

With Mr. Burton's gates side entrances are always made which cost £12 to £30; but with the use of wooden gates, we take advantage of an adjacent side sewer which answers the purpose of a side entrance, or where a side sewer is not convenient; we merely put foot irons up the sides of the sewer, on which a man may stand to work the gate, and be out of danger of the flush of water, Good elm gates would certainly last in the sewers from ten to twenty years. They have been known to last in similar situations much longer. I think many of them, well made, would last in the sewers thirty years.

Greateconomy in conneetion with the use of wooden gates by avoiding the expenses of side entranees.

Durability of wooden gates.

The prevention of effluvia in the present Metropolitan Sewers would be a work of very great expense and difficulty. To institute a perfect system of ventilation by means of air and fire shafts, to consume and disperse the foul air, would require more than a million of pounds, and many thousands of pounds annually for attendance and fuel. To accomplish this work by the use of the present deodorizing fluids would be equally impracticable on account of the expense. It is very probable that a perfect and practicable remedy for the evil of the smells may never be found for a system, wherein the foul air is allowed to generate.

Expense and difficulty of preventing effluvia in *existing* sewers by air shafts and deodorising fluids.

I believe all the very foul effluvia which escapes into the streets, and is experienced on the river and is generally found in the sewers, could never be produced in *a perfect system of sewers*, a system throughout which *a constant run of water* were maintained; and if there were used in connection with such a system, the practice of street-cleansing by water, the water after it had cleansed the streets would greatly assist in cleansing the sewers, and consequently preventing effluvia. Some virulent gases can be generated, only after certain contents of sewers and cesspools have remained stagnant a very considerable time. The contents of the most dangerous cesspools, when first introduced into those receptacles were *harmless*, their subsequent malignant character was derived from stagnation. The matter which would find its way into a perfect system of sewers, by

The present evils could not exist in a perfect system.

The benefits of street-cleansing by water in relation to the prevention of effluvia in sewers.

Stagnation, or want of currentsin sewers, necessary to

the existence of virulent gases.

moving rapidly, and mixing with the water, might be deprived of what little noxious quality it might have on its introduction; but if that same matter were to enter into many parts of our present sewers it would remain stagnant, and become continually more noxious, until neither combustion nor animal life, could be sustained within its influence.

The remedy for the evil of effluvia.

The effectual way of preventing very foul air and deadly gases in future sewers, appears to me, from what experience I have had, very plain. Let the sewers be constructed of proper size and form, and have a sufficient inclination, then the matter from water-closets and manufactories, and slaughter-houses, may be quickly conveyed away under a stream of water, without giving off exhalations likely to affect the public health.

If the mischief, arising from the present exhalations of drains and sewers, is to be considered as bearing a proportion to, and depending on the extent of their evaporating surface, then the mischief might be reduced to a minute fraction of its present magnitude without interfering adversely with the efficiency of the drainage; and if the sizes of sewers and drains are to be considered as regulating the very existence of the effluvium itself, then by proper constructions alone, without reference to a deeper ultimate main line, such as the River Thames, the present evils of the sewers might, for the most part, be placed under perfect control. All the flushing men agree in their evidence as to the fact, that the smell in the sewers depends on the quantity of the deposit and the current of water; and we find invariably, that the quantity of deposit in a sewer, and the rapidity of the current, depends on, and is regulated by the relation of the size of the sewer to the quantity of water in it.

Certainty of the causes of effluvia in sewers.

Limits to improvements in the drainage while the Thames remains part of the system. No limitation to improvements under known and practical conditions.

While the Thames remains the ultimate line for the drainage of the Metropolis; the currents of sewage can be improved and regulated only by attention to the improvements in the construction of sewers; and by the necessary attention, the currents might be very much improved even in the present imperfect system, or detached parcel of sewers; but if a system of drainage were adopted, wherein the sewage were diverted from the Thames into a *deeper channel*, and afterwards raised for distribution, then there might be no limit given to the velocities of the currents, and consequently to the diminution of the present evils of the existence of effluvia.

(Signed) J. LYSANDER HALE.

January 8th, 1849.

Printed at the Court House, 1, Greek-street, Soho:—By T. Ballard.